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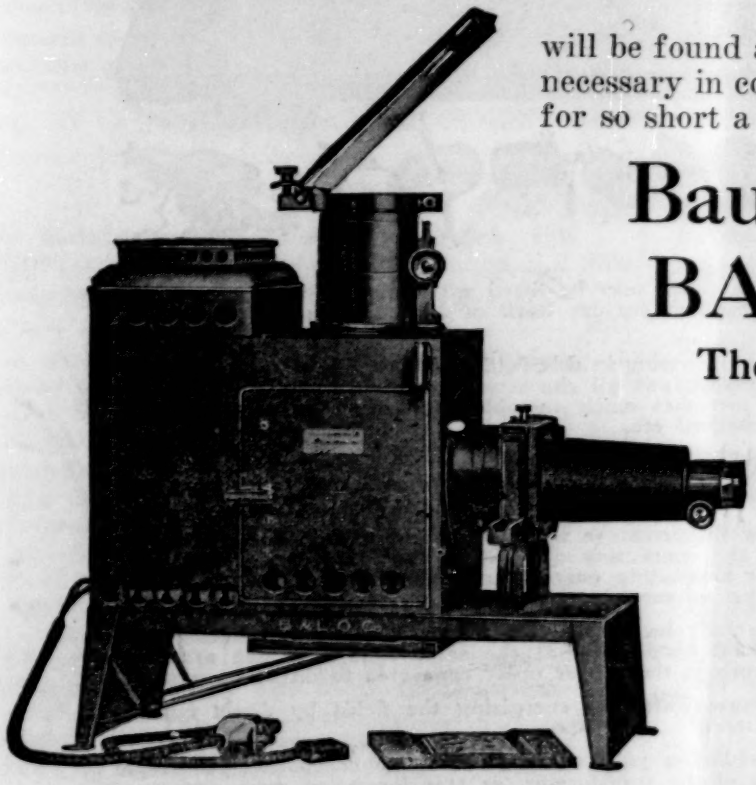

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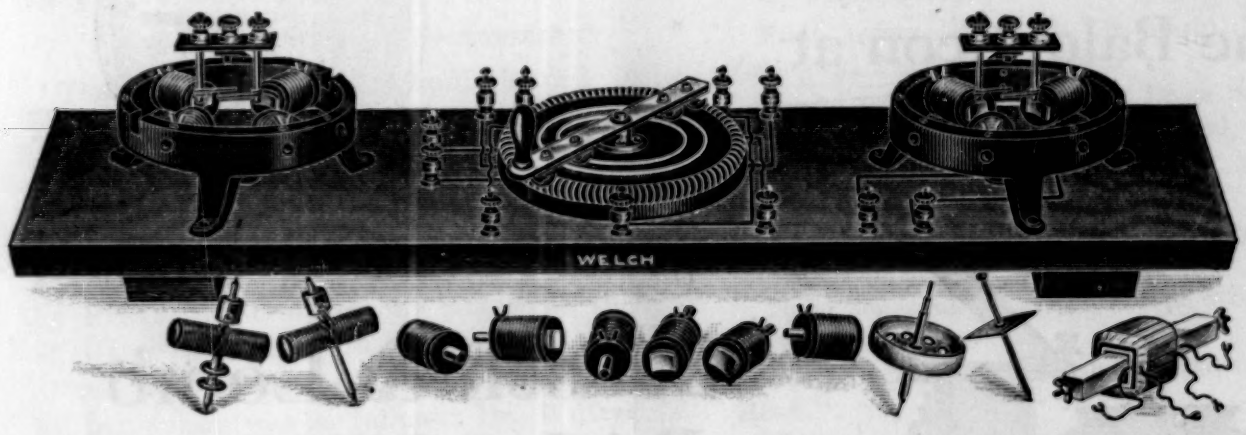

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THE MAINTENANCE OF SCIENTIFIC RESEARCH[1]

BROADLY taken, the apparatus of prosecution of research in this country is made up as follows: (1) Scientific and professional societies and some institutions entirely privately supported; (2) universities and colleges, with their scientific departments; (3) institutions, using that term in the widest sense, directly subventioned by the state, such for instance as the Medical Research Council, the Development Commission, and the Department of Scientific and Industrial Research. Of these three categories, the first named, the scientific societies group, works without financial aid from the state, apart from the small though extremely useful two government grants distributed, mainly to individual workers, through the Royal Society. At the present time many of the societies sorely need financial help to carry on their labors, and some are absolutely at a loss to know how to publish the scientific results that are brought to them. The second category, the universities and colleges, depends in part upon government aid. In the aggregate of twenty-one institutions of university rank, following Vice-Chancellor Adami's figures, students' fees and endowment provide about 63.5 per cent. of the total income; for the rest they are dependent on government grant. The third category, as said, draws state-support direct.

This triple system may seem a somewhat haphazard and incoordinate assembly. Yet in reality it is an organization with much solidarity, and its coordination is becoming more assumed. Its parts dovetail together. The first group, the scientific and professional societies, is provided with a medium of intercommunica-

[1] From the presidential address delivered at the anniversary meeting of the Royal Society and printed in *Nature*.

tion and co-action, the Conjoint Board of Scientific Societies. As to the separate categories composing the triple system itself, they also are in wide touch one with another. Between the scientific and professional societies on one hand and the universities on the other, contact and inter-relation are secured by some degree of free and rightful overlap, both as regards general subject-matter of research and of their *personnel*. Finally, there is excellent contact between both these categories and the third, the state subventioned institutions. A special feature of the policy and administration of these state organizations secures this, a feature which makes the whole of this subject the more cognate to the purview of our own society. To exemplify I may turn, for instance, to the Development Commission. Its program of fishery research, avoiding the terms "pure" research and "applied" research in view of the possible implication that pure research does not lead to practical result, directs research not alone to the solving of particular economic problems. It supports more especially what it terms "free" research, investigation in this case of the fundamental science of the sea and of marine life.

Again, with the Advisory Council of Scientific and Industrial Research, its program, gradually defined during the past six years, is laid down as having four main points: (1) the encouragement of the individual research worker, particularly in pure science; (2) the organization of national industries into cooperative research associations; (3) the direction and coordination of research for national purposes; and (4) the aiding of suitable researches undertaken by scientific and professional societies and organizations. It recruits researchers by giving financial opportunity to promising students to be trained in research, attaching them to experienced researchers. In short, it apprentices to research a number of selected younger workers in universities, colleges and other institutions scattered throughout the country.

So, similarly, the Medical Research Council. Its secretary, Sir Walter Fletcher, in an illuminating presidential address to Section I of the British Association meeting this summer, said, speaking of the nexus between scientific research and the progress of medicine, "It is the accumulating knowledge of the basal laws of life and of the living organism to which alone we can look for the sure establishment either of the study of disease or of the applied sciences of medicine."

It is evident, therefore, that, with a policy based on such principles as these, the third category in the triple system constituting the organization for scientific research in this country is one which has common aim and solid touch with both the others, the universities and the scientific and professional societies. One sees in short that the organization which has come into existence and is maintaining scientific research in this country is a real organization. It did not spring fully equipped from the head of Zeus. It has grown up rather than been planned. In that respect it is an organization essentially British, and it seems qualified to do its work for the country well. We hear of adventures, political and other, the offspring of the day. But these were no adventures, these, to my mind, welcome, long-overdue steps forward by the state toward the succor of science and its welfare, steps that help to strengthen and consolidate the organization for research by such adjuncts as the Medical Research Council and the Department of Scientific and Industrial Research. One of the strengths of this organization that has arisen is, in my view, that it interlocks with the educational system of the country. It is an organization which proceeds on the wise premise that, in the case of science, the best way to get the fruit is to cultivate the tree. It is an organization which is proving successful and economical. Its output has proved a more than liberal return on the funds at its disposal.

But essential to its continuance is continuance of adequate financial support from the government. A tripod can not stand upon two legs. The state-contribution in this country is relatively not large, but it is most important. Important as it has been in the past, it has now an importance most especially great. The cost of investigation is now higher, much higher than it has been. Endowment funds carry less far than they did carry. Private benefac-

tions and voluntary generosity, although willing, are less able to be found and less capable at this time; already gauged as inadequate of themselves alone before the war, they obviously can not alone cope with the necessary undertakings now. The present is a time when a large-scale withdrawal of the government's financial support must prove most formidably crippling. Such crippling will be greater than the actual measure of the sum withdrawn would entail in ordinary times.

To pull down under emergency what has been built up through years of careful experience and is proving efficient can scarcely be ultimate economy. It is to unlearn a useful lesson learnt. Curtailment of the state aid—relatively small in this country—given to scientific research must harm the scientific production of the country. Some curtailment, however, at this time seems unavoidable. Though extension of buildings and equipment and *personnel* is wanted, it may be necessary to withhold that extension at this time, maintaining broadly the *status quo* ready for expansion when that is once more feasible. But if research be an indispensable factor in the rebuilding of the national life, sacrifices should not be required from it disproportionately greater than from other services of a similarly essential kind. Reduction of the state's support on a scale to entail ruin to the existent organization would be a wastage rather than an economy. Calmly viewed, what more reminiscent of the wastage of the war itself than for machinery actually constructed, assembled, and producing what is needful for a nation's strength as a pillar in the industrial and intellectual temple of the world, to be now under temporary change abandoned or broken up; and at a time when industry as a whole stands convinced of scientific research as a necessity for its recovery and well-being.

My hope would be that scientific research on its present maintenance will be considered part of the intellectual bread of the community, part of the bed-rock on which rests the efficiency, not to speak of the industrial equipment, of the nation; that it will be treated as such in the measure of state-support continued to it; that the state will remember that that support has to embrace at least both the universities on one hand, and, on the other, the research institutions administered by the state, for this reason, namely, that the country's organization for research, complex in origin, yet economical and effective, stands as an integral system to the entire existence of which is essential an adequate state provision for both these constituent elements, indispensable, since they are, to the whole structure of the system.

C. S. SHERRINGTON

HENRY MARION HOWE

IN the death of Professor Howe the world lost both a great scientist and a great teacher. There has been recorded in various places the account of his life and life work, of his honors and of his publications. When in 1917 he was presented with the John Fritz medal of the United Engineering Societies a complete record of his work as a metallurgist, as a teacher and as a writer was given, together with a list of his professional papers, of which there are over 300 titles (*Monthly Bulletin A. I. M. E.*, July, 1917, p. 30).

Henry Marion Howe died on May 14, 1922, at his residence in Bedford Hills, N. Y., after an illness of over a year. He was born at Boston, Mass., in March, 1848, the son of Dr. Samuel G. and Julia Ward Howe. His father was noted for his philanthropy and distinguished services in the Greek war for independence, while his mother, the author of the "Battle Hymn of the Republic," was a leader of many reforms, from the abolition of slavery to woman's suffrage. As Dr. Raymond at the presentation of the John Fritz medal said, "It was a good stock on both sides, making him heir to intellectual keenness and refinement, the capacity for both enthusiasm and perseverance, a passion for the pursuit of knowledge and a gift of clear and felicitous statement." For he was imbued with the spirit of scientific research, the love of investigation, a striking power of observation and of interpretation, to which was added his wonderful clearness in expressing his thoughts not alone in his writings but more especially in his lectures and in the presentation of his papers at scientific meetings.

Graduating from the Boston Latin School in

1865, he received the degree of A.B. from Harvard in 1869 and the B.S. in mining and metallurgy from the Massachusetts Institute of Technology in 1871. The following year he received the degree of A.M. from Harvard, followed by the LL.D. in 1905.

The practical side of his life began in iron and steel. He was superintendent of the Bessemer Steel Works, Joliet, in 1872, and of the Blair Iron and Steel Company, 1873-74. For some five years he devoted himself to the metallurgy of copper and improved copper smelting in Chile for the heirs of Augustus Hemenway, and then designed and built the works of the Orford Copper Company at Capelton and Eustis in the Province of Quebec and at Bergen Point, N. J., 1879-1882. This latter year he was manager of the Pima Copper-mining and Smelting Company of Arizona.

From 1883-97 he was a consulting metallurgist in Boston and at the same time lectured in metallurgy at the Institute of Technology. In 1897 he was called to the chair of metallurgy at Columbia University and became professor emeritus in 1913.

His notable books were "The Metallurgy of Steel," 1888 (translated into French) and "The Metallography of Steel and Cast Iron," 1916. They were both epoch making. In the first he accumulated all the notable interesting material in the metallurgy of steel and with amazing insight arranged it so logically and so clearly as to bring out the significant similarities rather than the striking differences. In his last book we have a record of his own creative work and his interpretations of the newer results in metallography, striking out into a path far remote from the ordinary text-book and leading to a new country of thought and investigation.

His honors were many and varied and showed that his work and life were appreciated not only at home but abroad. He was Knight of the Order of St. Stanislas of Russia and Chevalier of the Legion of Honor, France. He had honorary membership in many of the societies, from the Royal Swedish Academy of Scientists to the Société d'Encouragement pour L'Industrie Nationale of France. He held fellowships in many of the academies and was president of the American Society Testing Materials, the American Institute Mining Engineers, the International Association for Testing Materials and honorary vice-president of the Iron and Steel Institute of Great Britain.

He received the Bessemer medal of the Iron and Steel Institute of Great Britain, Eliot Cresson medal, Franklin Institute of Philadelphia, gold medal of the Verein zur Befoerderung des Gewerbfleisses, Berlin, gold medal of Société d'Encouragement pour l'Industrie Nationale of France, 1916, and John Fritz medal, United Engineering Societies, 1917. He received honorary doctor's degrees from Harvard, Lafayette and the University of Pittsburgh.

But it is as a teacher and as one who has followed the paths of research that Professor Howe should be honored above all. As a lecturer his diction was most simple and his ideas and logical development of thought so clear that the dullest could not help but understand it. In fact, his courses seemed very easy compared with collateral reading from text-books and the like, and to those of us who had the privilege of working with him in the laboratory his inspiration was immeasurable. Possessed of a kindly personality, he took a fatherly interest in us all and spared no pains in our training. His methods were new, too new for many of his associates to understand or appreciate, for he believed that science must be followed in an orderly and well-thought-out manner, that the problem should first of all be stated, our knowledge of the subject be reviewed and then a complete plan of campaign laid out before any experimental work was started, for he had no use and less respect for the old cook book methods of metallurgy, which unfortunately are not yet quite a thing of the past. Another marked characteristic was his tolerance and patience. While the systematic planning of work came naturally to him, yet he realized the difficulties in the paths of others and was never intolerant or unkindly critical when things went wrong, even when his advice had been neglected. Each of us was made to feel that he was a co-worker and not merely an assistant, and in that way the best of each of us was brought out and developed.

His thoughtfulness of others was always uppermost in his mind, and many a man had cause to thank him for pecuniary help, which was always made available in such a way that the most sensitive could not feel any hurt to his pride. "Outside jobs" were frequent; very often they were doubtless thought up by Professor Howe himself, and they were always paid for most generously.

In 1874 he married Fannie Gay, of Troy, who survives him. She was deeply interested in his work and always accompanied him on his travels and in his attendance at all scientific conventions. She so looked after him that she helped him to conserve his energy for the main purpose; in fact, without her aid he could never have accomplished all that he did. She was as much interested in his students as he was himself, and the little luncheons and dinners at their home were affairs to be sought after and remembered, for she knew us all by name and also knew all our old instructors—often from an angle new to us.

An enthusiastic advocate of the cause of the Allies, he served during the war and later as chairman of the engineering division of the National Research Council. He worked incessantly, and with his wonderful and extraordinary energy and activity he accomplished a great deal in the study of improved methods of the open hearth process and the methods of production of new alloy steels and their physical properties.

In short, we can say of him that he was a kindly gentleman, thoughtful of others; a great scientist, greatly honored and yet most modest; a remarkably clear writer with a gift of simplicity of thought and diction; and, lastly, he was undoubtedly the greatest of all the steel metallurgists.

WM. CAMPBELL
COLUMBIA UNIVERSITY

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE SALT LAKE CITY MEETING

THE summer meeting of the American Association for the Advancement of Science, to be held at Salt Lake City, June 22 to 24, will be a joint meeting of the American Association with the Pacific Division of the association. This will be the seventy-fifth meeting of the association and the sixth annual meeting of the Pacific Division and its affiliated societies. The illustrated preliminary announcement of the meeting has recently been published and mailed to all members of the association.

The meeting will be held under the auspices of the Pacific Division. Dr. Barton Warren Evermann, president of the division, will preside at the general sessions and will deliver the presidential address at the opening session on Thursday evening, June 22. The general secretary of the association, Dr. D. T. MacDougal, will represent the larger organization. The hosts for this meeting are the University of Utah, the Utah Academy of Sciences, the Utah Agricultural College and the Brigham Young University. Much valuable help is being rendered by the City of Salt Lake, the Union Pacific System, the Hotel Utah and the Commercial Club of Salt Lake City.

A glance at the preliminary announcement shows that the Salt Lake City meeting will be successful in every way, an interesting and valuable meeting for all who attend. The city itself is unusually interesting from many view-points—scientific, educational, religious, commercial, social and artistic. The vicinity is famous for its agriculture and for its mining activities. The summer climate is very enjoyable, with sunny days and cool nights. Opportunities for the pleasures of outdoor life are furnished by the broad streets with their stately shade-trees, the beautiful parks and boulevards, the many canyons in the vicinity, and the famous bathing beach on Great Salt Lake.

The Hotel Utah is to be the official headquarters. No special railway rates will be available for those who attend this summer meeting, but advantage may be taken of the extraordinarily reduced summer excursion tariffs. The following examples give round-trip rates to Salt Lake City from the places named: From San Francisco, Sacramento, Oakland, Berkeley, Fresno, San Jose and Los Angeles, $48.82; from Denver, $36.10; from Omaha, $50.25; from Kansas City, $50.25; from St. Paul, $62.30; from Chicago, $60.00; from St. Louis, $56.00; from Memphis, $73.60; from New Orleans, $85.15; from Fort Worth, $64.15.

Liberal round-trip summer rates will be available for those wishing to proceed beyond Salt Lake City, with stop-over privileges at that point and elsewhere. Local railway agents should be consulted for exact information.

Some of the features of the varied program of the meeting are the following: A conference on "Research Problems of the Great Basin" will be held at noon on Thursday, June 22. Dr. John A. Widtsoe, past president of the University of Utah, will lead the discussion, and delegates from Pacific Coast institutions will take part. President Evermann's address Thursday evening will be on "The Conservation and Proper Utilization of our Natural Resources." Following this address there will be a general reception.

The afternoon of Friday will be devoted to a symposium on "The Problems of the Colorado River," with the following titles, several of which represent changes made in the program since the publication of the preliminary announcement: (1) "Description and physiography of the Colorado River Basin," Dr. Frederick J. Pack, Deseret professor, department of geology, University of Utah; (2) "Geology of the Colorado River Basin with reference to the engineering problem," Professor Bailey Willis, professor of geology, Leland Stanford, Jr., University; (3) "The vegetation of the Colorado River Drainage Basin," Dr. Frederic E. Clements, Carnegie Institution of Washington; (4) "The Algerian Sahara," Professor E. V. Gautier, Faculty of Letters, University of Algiers, and exchange professor, Harvard University; (5) "The conservation of the waters of the Colorado River from the standpoint of the reclamation service," Mr. Frank E. Weymouth, chief engineer, United States Reclamation Service; (6) "The interstate and international aspects of the Colorado River problem," Dr. C. E. Grunsky, vice-president of the Pacific Division, American Association for the Advancement of Science, San Francisco, California.

All members of the association and of the affiliated societies should attend the banquet Friday evening, at which an address will be given by the distinguished writer and student of human evolution, Professor James Harvey Robinson, of the New School of Social Science, New York City.

Saturday will be devoted to excursions and entertainment. A free organ recital will be given in the Tabernacle, and there will be a trip to the famous Saltair bathing beach. In the evening Dr. J. E. Broaddus will give an illustrated lecture entitled "From the Grand Canyon to the Yellowstone."

The distinguished Dutch evolutionist, Dr. J. P. Lotsy, of the Holland Society of Science in Haarlem, is expected to give a talk on evolution, probably on Thursday.

The regular section organizations of the association will not hold sessions at the Salt Lake City meeting, but many scientific societies and groups of workers will present programs. Among these are the American Physical Society, the American Meteorological Society, the Pacific Division of the American Phytopathological Society, the Cooper Ornithological Club, the Ecological Society of America, the Pacific Coast Entomological Society, the Pacific Slope Branch of the American Association of Economic Entomologists, the Plant Physiologists, the Society of American Foresters, the Western Psychological Association, the Western Society of Naturalists, the Agronomists and Soil Experts.

Correspondence regarding the preparations for the summer meeting should be addressed to Mr. W. W. Sargeant, secretary of the Pacific Division, A. A. A. S., Golden Gate Park, San Francisco.

BURTON E. LIVINGSTON,
Permanent Secretary

SCIENTIFIC EVENTS

THE SPENCER FULLERTON BAIRD MEMORIAL

A NATIONAL movement has been inaugurated in Washington to commemorate on February 3, 1923, the one hundredth anniversary of the birth of Spencer Fullerton Baird. Through a local organizing committee of twenty-six members, of which Dr. Hugh M. Smith is chairman and Dr. Paul Bartsch is secretary, a permanent national organization has been effected with the following officers: *Honorary president,* Dr. William H. Dall, Washington, D. C.; *presi-*

dent, Dr. Charles D. Walcott, Washington, D. C.; *vice-presidents,* Mr. G. R. Agassiz, Boston, Mass., Dr. Alexander Graham Bell, Washington, D. C., Professor F. W. Clarke, Washington, D. C., Professor Stephen A. Forbes, Urbana, Ill., Dr. David Starr Jordan, Stanford University, Cal., Professor Edwin Linton, Columbia, Mo., Professor Edward S. Morse, Salem, Mass., Professor Henry Fairfield Osborn, New York, N. Y., Professor Addison E. Verrill, New Haven, Conn., and Professor Robert S. Woodward, Washington, D. C.

Steps are now in progress for the formation of a national committee, and Dr. Walcott has addressed letters to various persons inviting them to become members of the committee, and to scientific bodies inviting them to name representatives to serve on the committee, and individuals and organizations have been asked to submit suggestions in regard to the general subject of the memorial.

While Spencer Fullerton Baird's scientific attainments and public services are well and widely known, the letter which Dr. Walcott has sent out recalls that Baird was the secretary of the Smithsonian Institution, the virtual founder of the United States National Museum, the creator and head of the United States Fish Commission, and a prime mover in the establishment of the United States Geological Survey and the Bureau of American Ethnology.

His personal contributions to knowledge in the domain of biology were numerous and profound. His ability and achievements, his fidelity to the public weal, his unselfish devotion to duty, the encouragement and aid he extended to other workers, and the beauty and simplicity of his character combined to produce one of the most noteworthy figures in our national history and one whom America will undoubtedly delight to honor on this appropriate occasion.

Up to the present time the matters that have been decided upon are a public meeting in Washington on February 3, 1923, at which addresses will be delivered and announcements made of the memorial or memorials that have been determined on, and the placing of wreaths on the grave of Baird in Oak Hill Cemetery, the bust of Baird in the American Museum of Natural History, the Baird memorial boulder at Woods Hole, and the Baird memorial tablet at the Bureau of Fisheries building in Washington.

Among the suggestions that have been made for a permanent national memorial are (1) a bust, statue, mural or open-air fountain, or bronze mural tablet to be provided by voluntary subscriptions and erected in the grounds of the Smithsonian Institution or the National Zoological Park, and (2) a fishery museum or exhibit, with public aquarium, embracing both the scientific and applied features of fishery problems, to be established by Congress under the auspices of the Smithsonian Institution.

It has been suggested also that there be established a Baird memorial medal to be awarded periodically to persons performing noteworthy original or meritorious work in science, and that there be published during 1923, preferably under the auspices of the National Museum or the Smithsonian Institution, a memorial volume to be made up of original papers on scientific subjects contributed by Baird's associates, colleagues and immediate followers.

HUGH M. SMITH

COSMOS CLUB,
WASHINGTON, D. C.

INTERNATIONAL CONGRESS OF THE HISTORY OF MEDICINE

ACCORDING to the program as abstracted in the *British Medical Journal,* as already announced, the Third International Congress of the History of Medicine will be held in London this summer from July 17 to 22. The congress will be opened by the minister of health at the house of the Royal Society of Medicine, on Monday, July 17, at 10:30 a.m., after which the delegates from foreign countries will be received, and the president, Dr. Singer, will give his address. In the afternoon the president of honor, Sir Norman Moore, will give a reception and address at the Royal College of Physicians; in the evening there will be a reception and conversazione by Dr. and Mrs. Singer at the Royal Society of Medicine, and an address by Professor Elliot Smith. Morning sessions for papers and discussions will be held on Tuesday, Wednesday, Thursday and Friday, and after-

noon sessions on Tuesday, Thursday and Friday. Receptions will be given on Tuesday afternoon by the Lord Mayor and Lady Mayoress, at the Mansion House; on Tuesday evening by Sir James Purves Stewart and Lady Stewart; on Wednesday afternoon by the president of the Royal College of Surgeons of England, at the college; and on Thursday evening by Mr. and Mrs. H. J. Waring. On Wednesday afternoon visits to Barbers' Hall and Apothecaries' Hall have been arranged, and in the evening there will be a conversazione at the Wellcome Historical Medical Museum, where a special loan exhibition will be on view. On Friday afternoon Sir D'Arcy Power will give a historical address at St. Bartholomew's Hospital, and in the evening a banquet will be held at the Hotel Cecil. On Saturday Hampton Court Palace will be visited. Those wishing to become members of the congress are asked to communicate as early as possible with the general secretary, Dr. J. D. Rolleston, 21, Alexandra Mansions, King's Road, S.W.3, London.

RESEARCH FELLOWSHIPS ADMINISTERED THROUGH THE DIVISION OF BIOLOGY AND AGRICULTURE OF THE NATIONAL RESEARCH COUNCIL

Inasmuch as the announcement of medical fellowships to be administered by the National Research Council has called forth many inquiries regarding fellowships in biology and agriculture, it seems desirable to set forth briefly the situation in this division. Notwithstanding the many worthy applications which have reached it, the Division of Biology and Agriculture has not yet been successful in securing a series of general fellowships comparable to those provided by the Rockefeller Foundation through the Divisions of Physics and Chemistry, or those financed by the Rockefeller Foundation and the General Education Board for the Division of Medicine. The Division of Biology and Agriculture does have administered through it directly or indirectly, however, a series of special fellowships, as follows:

The Rosenwald fellowship with a stipend of $2,000 a year for three years, donated through the General Education Board to Dr. E. E. Just for his studies on the physiology of development.

Two Sigma Xi fellowships at $1,600 each, supported by the membership of the Sigma Xi Society. The present policy is to award these in subjects other than physics and chemistry and the medical sciences. The chairman of this division acts *ex officio* with the fellowship committee of Sigma Xi in their administration.

Two Crop Protection Institute Sulphur fellowships (beginning in 1922) at not to exceed $2,500 each, donated by three sulphur companies; an additional $2,500 is to be used in organization work. One of these fellowships is to be assigned to a phytopathologist, the other to an entomologist.

Eight sulphur fellowships (beginning in 1922) at approximately $1,000 each for one year, with assurance of further support, donated by the Texas Gulf Sulphur Company (see Science, May 26). Two thousand dollars additional is provided for the traveling expenses of those concerned with the research.

M. F. Guyer, *Chairman*
Committee on Fellowships,
Division of Biology and Agriculture

AMERICAN METEOROLOGICAL SOCIETY

The American Meteorological Society will hold its first western meeting at Salt Lake City on June 22. Western members have arranged a program of varied interest, which will probably occupy all of June 22 and the morning of the 23d. Of particular interest will be the several papers on climatology in relation to agriculture and forestry to be presented on the morning of the 22d, and the symposium on "Forecasting Irrigation and Flood Waters," led by Dr. J. E. Church, Jr., director, Nevada Cooperative Snow Surveys, on the afternoon of the 22d. It seems probable that at this meeting a Pacific division of the society will be organized in affiliation with the Pacific Division of the American Association for the Advancement of Science.

The society held a highly successful meeting in Washington on April 26, the proceedings of which are being published in the *Bulletin of the American Meteorological Society*.

Charles F. Brooks, *Secretary*
Clark University,
Worcester, Mass.

CHAIRMEN OF THE DIVISIONS OF THE NATIONAL RESEARCH COUNCIL

THE National Research Council has elected the following chairmen of its divisions for the year 1922-23:

Division of Foreign Relations: Robert A. Millikan, foreign secretary of the National Academy of Sciences, and director of the Norman Bridge Laboratory of Physics, California Institute of Technology, Pasadena, California.

Division of States Relations: H. S. Graves, dean-elect, School of Forestry, Yale University.

Division of Educational Relations: Vernon Kellogg, permanent secretary, National Research Council.

Division of Research Extension: W. M. Corse, formerly general manager of the Monel Metal Products Corporation, Bayonne, New Jersey.

Research Information Service: Robert M. Yerkes, National Research Council, Washington, D. C.

Division of Physical Sciences: William Duane, professor of bio-physics, Harvard University Medical School.

Division of Engineering: Alfred D. Flinn, secretary, Engineering Foundation, 29 West Thirty-ninth Street, New York, N. Y.

Division of Chemistry and Chemical Technology: Edward W. Washburn, professor of ceramic chemistry and head of the department of ceramic engineering, University of Illinois.

Division of Geology and Geography: Nevin M. Fenneman, professor of geology and geography, University of Cincinnati.

Division of Medical Sciences: Frederick P. Gay, professor of pathology, University of California.

Division of Biology and Agriculture: F. R. Lillie, professor of embryology, University of Chicago.

Division of Anthropology and Psychology: Raymond Dodge, professor of psychology, Wesleyan University.

THE U. S. COMMISSIONER OF FISHERIES

THE president, acting upon the recommendation of Herbert Hoover, secretary of commerce, has nominated Henry O'Malley to be commissioner of fisheries, effective on May 13, 1922, and this nomination has been confirmed by the Senate. Mr. O'Malley, like his predecessor, Dr. Hugh M. Smith, has had long experience in the bureau's service, having entered in December, 1897, as an apprentice fish-culturist at St. Johnsbury, Vermont, in which place he was born in 1876. From St. Johnsbury he was transferred to the bureau's station at Leadville, Colorado, thence to Baker Lake, Washington. In July, 1903, he was appointed superintendent of the Washington stations; in 1907, of the bureau's work in the Columbia River watershed; in 1913, he was placed in charge of all fish-cultural work on the Pacific coast, with headquarters at Seattle; in 1916, he was made chief of the Division of Fish Culture in Washington and in 1918 placed in charge of all the bureau's activities on the Pacific coast.

The commissioner is responsible for a number of innovations in fish-cultural practices, such as the discovery of the salt-solution process for separating dead fish eggs from the live ones, eliminating the necessity of removing dead eggs by hand, and the practice of holding young salmon beyond the period when the yolk-sac is absorbed, the wisdom of which has been indicated by the improved run of salmon in such streams.

For the past three years he has spent the entire fishing season in Alaska engaged in comprehensive investigations of the fisheries of this region in conjunction with Dr. Charles H. Gilbert, of Stanford University, the results of which have been published in bureau reports for 1919 and 1920.

In 1916 he was elected president of the Pacific Coast Fisheries Society and in 1918 president of the American Fisheries Society. Mr. O'Malley enters the commissionership with a full acquaintance of the needs of the service and its possibilities for rendering fruitful service in its various phases.

SCIENTIFIC NOTES AND NEWS

THE degree of doctor of science was conferred at the one hundred and sixty-eighth commencement of Columbia University on Dr. Stephen Smith, the university's oldest living graduate, and on Frank Julian Sprague, the electrical engineer.

DR. JOHN J. CARTY, president of the American Telegraph and Telephone Company, re-

ceived the degree of doctor of laws at the commencement exercises of New York University.

THE State University of Iowa conferred at the recent commencement exercises the doctorate of laws on Mr. Vilhjalmur Stefansson and on Dr. Franklin H. Giddings, professor of sociology in Columbia University, who delivered the commencement address.

THE degree of doctor of science was conferred by the Kansas State Agricultural College on C. V. Piper, in charge of forage crop investigation, United States Department of Agriculture, and on Walter T. Swingle, in charge of the office of crops physiology, United States Department of Agriculture.

AT the commencement exercises of the University of Maine the doctorate of science was conferred on Leon S. Merrill, dean of the College of Agriculture; Professor Jeremiah S. Ferguson, of Cornell University; John Belling, of the Carnegie Institution, and Josiah W. Votey, dean of the College of Engineering, University of Vermont, and the doctorate of engineering on Harold S. Boardman, dean of the Maine College of Technology.

TRIBUTE to the services of Dr. John Deaver and Dr. John Marshall, who retire at the end of the present academic year as professor of surgery and professor of chemistry and toxicology, respectively, was paid at the last meeting of the Board of Trustees of the University of Pennsylvania, by the passage of the following resolutions:

RESOLVED, That the trustees receive with very great regret the resignation of Dr. John B. Deaver as John Rhea Barton professor of surgery in the School of Medicine, taking effect June 30, 1922, and the secretary be instructed to convey to Dr. Deaver the regret of the trustees at the ending of his distinguished term of service.

RESOLVED, That the trustees are gratified to learn that Dr. Deaver will remain on the university instructional staff, retaining his position of professor of surgery in the Graduate School of Medicine.

RESOLVED, That the trustees receive with very great regret the resignation of Dr. John Marshall as professor of chemistry and toxicology, in the School of Medicine, taking effect June 30, 1922, and the secretary be instructed to convey to Dr. Marshall the gratitude of the university for his long and faithful service as a teacher and officer of the university, and their regret at the severing of his connection with the institution.

HAVING reached the age limit of seventy years on May 1, Professor Ramón y Cajal was retired from his connection with the chair of histology and pathologic anatomy at the University of Madrid. Spain and Latin America are taking the lead in organizing a tribute to him. Among the early features of this is the Cajal number of the *Archivos de Medicina* of Madrid.

A DINNER in honor of Professor Edwin G. Boring, professor of psychology, was given by the faculty of Clark University on May 31, with Professor Arthur G. Webster, of the department of physics, as toastmaster. Professor Boring is leaving Clark University to go to Harvard University.

THE annual Walker prizes of the Boston Society of Natural History were this year awarded as follows: A first prize of $100 to James W. Mavor, of Union College, Schenectady, N. Y., for his essay "On a modification of the mechanism of inheritance produced by X-rays"; and a second prize of $50 to Frank J. Wright, of Bridgewater College, Bridgewater, Virginia, for an essay on "The physiography of the upper James River basin in Virginia." At the annual meeting of the council of the society it was voted to elect Professor William Bateson, director of the John Innes Horticultural Institute, London, England, an honorary member.

THE Academy of Natural Sciences of Philadelphia has appointed Dr. R. A. F. Penrose, Jr., a delegate to the Thirteenth International Geological Congress in Brussels and Dr. Wm. P. Wilson a delegate to the Twentieth International Congress of Americanists at Rio de Janeiro.

ELEVEN of the twelve members of the committee of the League of Nations on International Cooperation in Intellectual work have been selected. These include in the sciences Madame Curie; Professor Albert Einstein; Miss Bonnevie, professor of zoology at Christiania; Dr. A. De Castro, of the medical faculty

of the University of Rio de Janeiro; and Dr. L. De Torres Quevedo, director of the electro-medical laboratory of Madrid. The commission will include a consideration of the three following topics: (1) possibilities of encouraging and improving the organization of scientific research by means of congresses, commissions and institutes; (2) the international relations between universities and means for the organization of an international bureau of universities, and possibly an international university; (3) international organization of scientific bibliography, and exchange of scientific publications.

THE officers elected in Section III of the Royal Society of Canada at the annual meeting in May were: *President,* Professor J. Watson Bain, of the department of chemistry of the University of Toronto; *vice-president,* Dr. J. S. Plaskett, director of the Astro-physical Observatory, Victoria, B. C.; *secretary,* J. Patterson, Meteorological Service, Toronto.

DR. NATHANIEL W. FAXON, assistant director of the Massachusetts General Hospital of Boston, has accepted the position of director of the Strong Memorial Teaching Hospital, which will be built in connection with the School of Medicine and Dentistry at Rochester University.

DR. J. C. WITT has been appointed a consulting chemist in the Bureau of Mines, and from time to time will cooperate with that bureau in the study of some phases of portland cement manufacture.

DR. A. G. JOHNSON, associate professor of plant pathology at the University of Wisconsin and pathologist of the Office of Cereal Investigations, Bureau of Plant Industry, U. S. Department of Agriculture, formerly stationed at Madison, Wisconsin, has transferred headquarters to Washington, D. C., where he will continue his work in the Office of Cereal Investigations. He has resigned his university appointment.

MR. R. L. HOWARD, who has been associate professor of chemistry in the Medical College of Virginia, has been awarded the research fellowship in pharmacology at Western Reserve University.

VICTOR K. LAMER, instructor in chemistry at Columbia University, has been granted a leave of absence for the coming year to accept the Cutting traveling fellowship for study abroad.

PROFESSOR L. MICHAELIS has received leave of absence from the University of Berlin to lecture on physiologic chemistry at the Japanese University of Nagoya.

MR. ERNEST E. HUBERT, assistant pathologist in the Office of Forest Pathology, cooperating with the Forest Service at the Forest Products Laboratory, left on June 7 for a field trip through Illinois, Missouri, Tennessee, Mississippi, Louisiana and Georgia. The purpose of the trip is a general survey of the problem of sap stains and molds on lumber. The methods of controlling the enormous losses due to these organisms will be studied in detail, and special attention will be given to the steaming and seasoning of sap gum and other lumber and to the treatment of southern yellow pine to prevent blue stain.

NEIL M. JUDD, curator of American archeology in the U. S. National Museum, left for New Mexico on May 1 to resume direction of the National Geographic Society's Pueblo Bonito Expedition. During Mr. Judd's absence John L. Baer will again serve as acting curator of American archeology.

DR. T. S. PALMER addressed the Biological Society of Washington on May 13 on "Twenty years of federal protection of the bison." A historical sketch of attempts to prevent the extinction of the bison was given; in 1922, there were over 10,000 bison in existence.

THE annual Jones' Lectures of the University of Oregon Medical School were given this year by Sir Thomas Lewis. The subjects were as follows: "The nature of auricular flutter and fibrillation as these occur in man," "The action of cinchona alkaloids," and "Digitalis."

THE annual meeting of the Canadian Medical Association will be held at Winnipeg from June 20 to 23, inclusive. Dr. Lewellys F. Barker, of Baltimore, is to give the address in medicine, and Dr. J. M. T. Finney, also of Baltimore, has been asked to give the address in surgery. The scientific work of the meeting will be car-

ried on in a surgical section, a medical section, an eye, ear, nose and throat section, and a general section; and, instead of a formal pathological section, a series of pathological demonstrations will be given. The Canadian Society of Anesthetists and the Canadian Radiological Society will also hold their annual meetings in Winnipeg at the same time.

THE Metals Committee of the Federal Specifications Board has been organized with Dr. G. K. Burgess, of the Bureau of Standards, as chairman, and Mr. Freeman, also of the bureau, as technical secretary. Several subcommittees have been appointed, and progress has been made in the formulation of metal specifications. The metals are being taken up in the following order: Ingots, castings and wrought metal. The subject of chains is also being considered by this committee. The American Society for Testing Materials methods of chemical analysis have been recommended for government check analyses.

THE National Committee on Exhibits Showing Advances in Sanitary Science has recently been formed in Washington, for the purpose of collecting and preparing material for a public health exhibit in the capitol. The members of the committee include: Surgeon General Hugh S. Cumming, U. S. Public Health Service, *chairman;* Dr. D. B. Armstrong, National Health Council; Surgeon General M. W. Ireland, M. C., U. S. Army; Dr. Victor C. Vaughan, National Research Council; Dr. C. D. Walcott, Smithsonian Institution, and James A. Tobey, National Health Council, *secretary.* Space for the proposed exhibit has been placed at the disposal of the committee by the Smithsonian Institution. Plans are under way to install exhibit material secured from official and voluntary health agencies. The secretary's office is in the national headquarters of the American Red Cross at Washington.

MR. MARCONI left Southampton on May 27 on board his yacht *Electra* on a voyage of wireless experiment to America. According to a report in the *London Times,* two technical assistants accompany him. He proposed to carry out experiments on the Atlantic with direction finders on short wave and long wave transmission. At New York he will conduct a number of tests in cooperation with some of the modern American stations, and demonstrate to the Americans what can be accomplished in the high speed dispatch and reception of messages. Over long distances, such as from America to England, messages are now received at a rate of eighty to ninety words a minute, and Mr. Marconi will use improved instruments by means of which speed can be increased up to one hundred words a minute and over. On June 20, Mr. Marconi, who has received from the Institute of Radio Engineers, New York, the medal of the institute, will deliver a lecture at a joint meeting of the Radio Institute and the American Institute of Electrical Engineers. His subject will be "Radio Telegraphy," but the question of wireless telephony will also be dealt with. Besides his other experiments, Mr. Marconi will carry out tests for the Meteorological Office in London during his voyage. These will have special reference to the collection of reports of the weather in the areas of the Azores and the Bermudas. He expects to be absent from England until the middle of July. On his return journey, he hopes to visit Canada and Newfoundland. The *Electra,* a steam yacht of 700 tons, will make the Azores her first objective, and thence will proceed to America, or, if the weather proves bad, to Bermuda.

THE United States National Museum has recently secured by purchase, through the cooperation of the United States Department of Agriculture, the large private herbarium of Dr. Otto Buchtien, formerly director of the Museo Nacional, La Paz, Bolivia, built up by him through many years of botanical exploration in South America and through exchanges with institutions in many parts of the world. The herbarium consists of approximately 45,000 specimens, and is notable for its large proportion of tropical American species, particularly of the floras of Bolivia, Chile, Argentina and Paraguay.

YALE UNIVERSITY has acquired a collection of 566 mounted game heads and skulls with horns, and miscellaneous zoological specimens and implements used by native hunters. This is the gift of Mr. Thomas D. M. Cardeza, sportsman and naturalist of wide reputa-

tion, who has hunted big game animals in most parts of the world. For the time being the collection will be set up in the Osborn Zoological Laboratory. Eventually it will occupy a prominent place in the new Peabody Museum, which has not yet been erected. It contains 179 fully mounted heads of large game animals with the front parts of their bodies in many cases. These heads range in size from that of an African elephant measuring eight feet six inches betwen the tips of the ears, to the diminutive dik-dik antelope, which approximates the size of a cat and which is the smallest of the ruminants. Among the African fauna are species of antelopes, including gnus, hartebeests, bushbucks, waterbucks, reedbucks and gazelles. One of the most striking exhibits is that of a great hippopotamus, the open mouth of which measures twenty-three inches between the lips. There are also included several rhinoceroses, zebras, buffaloes and wart hogs.

THE Prudential Insurance Company has made an unconditional gift of the public health, medical and scientific sections of its library to the Surgeon General's Library of the United States of America at Washington, D. C. This collection of books, documents and data is estimated to represent about ninety per cent. of the entire public health material for the civilized world, representing between fifty and one hundred thousand volumes and publications. The books will be transferred gradually to Washington, for re-installation on the main floor of the Surgeon General's Library, where a large section is being cleared for the purpose, to be hereafter known as the statistical division. The library includes countless reprints, articles and clippings on medical and related subjects, brought together during the last thirty years by Dr. Frederick L. Hoffman, the Prudential statistician. The books are down to date, and, as far as practicable, the series of official reports is historically complete. The library is arranged on the subject-index plan, readily accessible, while all possible facilities will be extended by the Surgeon General's Library to students in search of information generally out of reach. It is hoped to complete the installation by the first of next year. The gift has been approved by the surgeon general of the army, Major General M. W. Ireland, and the secretary of war, John W. Weeks.

IN line with the purpose of the Department of Commerce to make the textile section of the Bureau of Standards more available and of better service to the textile industry, a conference was called on May 20 of representatives of the various branches of the textile trade. The best means for bringing about the desired results and the formulation of a general plan for carrying on research work throughout the textile industry were discussed. Those present were much pleased with such a plan, and it was arranged that the various delegates should take up with their individual branches of the trade the question of the formation of committees, consisting of twelve to fifteen men each, for the purpose of working up the necessary plans and of holding meetings whenever desirable. A general meeting will be held in Washington in the autumn. This is the first opportunity of the kind given to the textile industry for carrying on collective research work.

CONSOLIDATION of the Bureau of Markets and Crop Estimates and Office of Farm Management and Farm Economics of the Department of Agriculture in order to bring the gathering of all data on the economics of production and marketing under one bureau, in accordance with recent legislative provision, will be completed by July 1. It is stated that the adjustment is being made in response to the demand from farmers for a closer correlation of economic data on production and marketing, to enable them to adjust production to meet changing marketing conditions in this country and abroad.

An expedition from the department of medical zoology of the School of Hygiene and Public Health of the Johns Hopkins University, will go to Porto Rico this summer to investigate hookworm disease. The expenses of this expedition will be paid by the International Health Board of the Rockefeller Foundation. The party will include Mr. D. L. Augustine, Mr. N. R. Stoll and Dr. W. W. Cort, from Johns Hopkins University, Dr. W. A. Riley, of the University of Minnesota, and Dr.

and Mrs. G. C. Payne, of the International Health Board. The expedition will be under the direction of Dr. W. W. Cort. The party will leave the United States early in June and will return about the first of October. The headquarters in Porto Rico will be Utuado, where a small hospital has been furnished by the Porto Rican Department of Sanitation for laboratory and living quarters. The expedition will work in cooperation with Dr. R. B. Hill, director for Porto Rico of the International Health Board, and Dr. W. F. Lippitt, commissioner of health of Porto Rico. The work of the expedition will include a continuation of the researches on the life of hookworm eggs and larvæ in the soil which were begun in Trinidad during the summer of 1921. Field studies will also be made of the sources of human infestation under the conditions in Porto Rico.

UNIVERSITY AND EDUCATIONAL NOTES

By the will of Seymour Coman, of Chicago, the University of Chicago is made trustee of his residuary estate estimated to be approximately $145,000, the net income from which is to be used for scientific research with special reference to preventive medicine and the cause, prevention and cure of diseases. This bequest is to be known as the Seymour Coman Research Fund. By the will of Alexander D. Thomson, of Duluth, Minn., the sum of $50,000 is bequeathed to the university for use in the medical department, to be expended under the direction of Dr. Wilber E. Post, a graduate and trustee of the university, and Dr. Herman L. Kretschmer.

It is reported that Wake Forest College School of Medicine is entitled to receive the principal of a trust fund, amounting to $1,375,000, which was created in 1892 by Jabez A. Bostwick, a director of the Standard Oil Company.

Dr. D. Wright Wilson, of the Johns Hopkins University, will succeed Dr. John Marshall in the chair of chemistry in the Medical School of the University of Pennsylvania.

G. F. Reddish, Ph.D. (Yale '22) has been elected associate professor of bacteriology, and Paul A. Warren, Ph.D (Michigan '22) has been elected professor of botany in the Medical College of Virginia.

Dr. Calvin P. Stone, of the University of Minnesota, has been appointed assistant professor of psychology at Stanford University.

W. L. Eikenberry has resigned as associate professor in the School of Education of the University of Kansas, to take the position of professor and head of the science department in the Pennsylvania Normal School at East Stroudsburg, Pa.

Dr. Colin G. Fink has been appointed lecturer in electrochemistry and will have charge of that division of the department of chemical engineering of Columbia University, beginning on July 1. He will continue his services as secretary of the American Electrochemical Society, office facilities having been arranged at Columbia for this.

Professor Mayer, who has recently held the chair of physiology in the Strasbourg Faculty of Medicine, has been appointed successor to the late François Franck at the Collège de France.

DISCUSSION AND CORRESPONDENCE

THE ORIGIN OF SPECIES

The recent address by Professor Bateson, at Toronto, has been variously interpreted. Among other things he is quoted as saying that "as to the origin of species we have no clear answer to give. Faith has given place to agnosticism . . . Although our faith in evolution remains unshaken, we have no acceptable account of the origin of species."

This statement must mean one of two things. It may be a large and generous gesture disclaiming for science any approach to omniscience, for the most that science can do is to record the "observed sequence of events." Or we may interpret it as a revelation of the speaker's ignorance of the researches of field investigators and of students of geographical distribution generally. It is evident that Bateson fails to distinguish between these and the taxonomists who, mostly in museums, have as he says "built up a vast edifice of knowledge

which they are willing to share with us and which we greatly need . . . The separation between the laboratory man and the systematists already imperils the work, I may say the sanity of either."

It is true that the accumulation of facts in regard to each one of hundreds of thousands of individual species shows endless variety in the details of modified divergence. It is therefore impossible to condense in a single phrase all that we know of its phases, unless with Darwin we use the term "Natural Selection" as the antithesis to supernatural creation and adjustment, thus including in one word not only the results of the Survival of the Fit, but also all other natural processes which may be coincident with it.

As a matter of fact, no phenomenon of nature is better understood than that of the origin of species, taking the word species in its original and natural definition as a definable form of animal or plant life as now existing on the globe. In the study of any one of these, we find the inherent factors of heredity and variation, the survival of individuals adapted to their environment, thereby perpetuating in a general way their particular traits. The groups thus formed lose their unity through "biological friction," "mating by propinquity," isolation, segregation or by whatever term we choose to indicate the effects of barriers. There is no better term than the one used by Moritz Wagner, *"räumliche Sonderung."* Thus taking the inherent life forces into consideration, adaptation is the result of sifting, species-moulding the result of bars to free movement within the species. Independent of the matter of adaptation, *sundering* separates groups with some differences in parentage and subjects them to new incidence of selection, so that in a longer or shorter time specific differences, usually non-adaptive, appear and become permanent. Whether the special variations are great or small in degree, mutations or fluctuations, is a secondary question, the latter most usually, but neither can become permanent except through *räumliche Sonderung.*

The origin of individual species of animal or plant runs closely parallel with that of individual words in a language. Each one of these springs from a "root"; through ancient documents (fossil records) the roots of words can be traced more perfectly than the roots of animal or plant species. Yet one may know the derivation of thousands of words while yet "expressing agnosticism" as to the origin of language.

The laws of distribution as to words or species alike may be summed up in simple propositions. Every word and every species is found in every part of the globe, unless (*a*) it has never found its way there, (*b*) it has failed to maintain itself, or (*c*) maintaining itself, it has been, through environment sifting or obstruction (selection or segregation), transformed into something tangibly different.

The Origin of Species for the most part is defined by proposition (*c*). The origin of any given species of the British fauna or flora, for example, can be traced from England to the Continent of Europe just as surely though not as accurately as a given word in the English language. The biological relations of words differ from those of animals or plants, but *räumliche Sonderung* produces corresponding results in both cases.

DAVID STARR JORDAN

THE KAIETEUR FALLS

TO THE EDITOR OF SCIENCE: I read with much interest in a recent issue of SCIENCE the account of the expedition of the New York Zoological Society to the Tropical Research Station at British Guiana. In this account was included a description of a visit to Kaieteur Falls, which were claimed to be the highest in the world. It seems a little unfortunate that the writer overlooked the fact that he has in his own country a magnificent waterfall which is several times as high as the one he described.

Quoting directly from the article, we find, "The Kaieteur Falls are the highest in the world, eight hundred and ten feet in all, about five times as high as Niagara." The statistics published by the Department of the Interior of the U. S. government give the height of the Yosemite Falls in the Yosemite Valley in California as more than twenty-five hundred feet in all, while the first sheer drop is fourteen hundred and thirty feet. I do not want to go on record as discouraging any one from visiting the Kaieteur Falls if the opportunity pre-

sents itself but I do agree with the advertising slogan of our railroads that we should "See America First."

Arthur C. Hardy

Rochester, N. Y.

MUSEUM PESTS FEEDING ON GLYCERINE JELLY SLIDES

Recently I accidently found, in an ordinary box of 100 microscopic slides, two Dermestid beetle larvæ, exhibiting what is an apparently new feeding habit for these museum pests, as far as I can ascertain from entomologists here.

The two larvæ I saw at different times actually feeding on the black rim of asphaltum encircling the cover glass of a few slides, two in one part and five in another part of the box. From these was removed from one fourth inch to fully one half of the periphery, exposing the mounting medium at the edge. Excess asphaltum on the upper surface was not touched, which shows, as well as do other points given below, that the asphaltum was not the chief attractive food substance in the case.

Glycerine jelly was the mounting medium in all these slides. All slides touched were fairly thick mounts, all practically thick enough for at least a small larva to get in beneath the cover glass. Two slides show rather large, broad, irregular tunnels in the jelly. I did not actually see larvæ at work in the jelly, but sufficient evidence was there. Besides these spaces in the jelly, which could not have been due to any flow of material, or made by any other agent, a great many larval hairs were stuck around the cover glass, and in decreasing numbers, on other parts of the slide, and a cast skin was stuck to one.

One of these larvæ was inadvertently crushed, and the other one later died. A couple of big Dermestid larvæ were secured and offered fresh glycerine jelly. They ate of it readily, but I also noticed that they became badly stuck up in a rather short time, and soon died. Such result would be rather fortunate for the slide owner, thanks to the consistency of the glycerine jelly. If there are few larvæ there probably will not be much damage then. Still some good specimens may be exposed to injury, and this happen long before the injury is noted. It is a feeding habit which the writer believes should be taken into account.

W. C. Kraatz

Ohio State University

NECTARINA IN TEXAS

My attention was first called to the presence of *Nectarina lecheguana* within the limits of the United States by a letter from a beekeeper living in the lower Rio Grande Valley, stating that there were insects there which made nests like the hornets and yellow jackets but stored honey like bees. He also stated that they swarmed like bees. An investigation of available literature failed to mention anything fitting the description given. A few months later, on visiting the region, several beekeepers confirmed the account and I was shown a number of abandoned nests but could find none which were occupied. My interest continued and I endeavored to secure specimens from friends living there. A few live insects were sent me in an ordinary queen cage. These were forwarded to the National Museum for identification and were identified by S. A. Rohwer as *N. lecheguana*. This species is recorded commonly from Mexico to Brazil, but so far as can be ascertained there is no previous record of its appearance north of the Rio Grande River. I have been unable to find any indication of its occurrence farther north than about twenty miles of Brownsville, Texas.

In the early summer of 1920 I secured a large colony which was shipped in its original nest to Hamilton, Illinois, in a cage by express. A few days after the nest was placed in the open, the insects absconded and were not located again for some time. They built a new nest as large as the old and at least one division established itself, but the third nest was much smaller. Since the insects can stand but little frost they could not survive an Illinois winter in the open.

These insects are remarkable in possessing so many characteristics of both bees and wasps. As already stated they make large paper nests like the wasps but they store up honey like the bees. When they sting, they lose their stings as do the honeybees. They show little resentment when one approaches the nest and I found no difficulty in observing their actions at close range. When a forager returned from

the field it would pass from one to another of those remaining on the outside of the nest and offer the new nectar which was eagerly accepted. From five to a dozen individuals would thus be fed before passing inside the nest where it was lost to sight.

This and other species of *Nectarina* are discussed at length by R. du Buysson in Annales de la société entomologique de France, Vol. 74 pp. 537-566.

FRANK C. PELLETT

HAMILTON, ILL.

SCIENTIFIC BOOKS

Geodetic Operations in the United States, January 1, 1912, to December 31, 1921. By WILLIAM BOWIE. Pp. 26, illustrated. (Washington, Government Printing Office, 1922, 20 cents).

This is a report which was presented in Rome in May, 1922, at the meeting of the section of Geodesy of the International Geodetic and Geophysical Union. It is reviewed from the point of view of a scientist. Otherwise the reviewer might call attention more directly to certain points in the report which are of interest to any one who would like to see all of the United States mapped well and soon.

The perusal of this publication, showing the contributions to geodesy by the Coast and Geodetic Survey in the past ten years, arouses admiration for the rapid progress which has been made in spite of the delays and disturbances due to war. The rate of accumulation of new observations for use in geodesy has been greater in the United States in this decade than in any previous decade. Along with this progress in observing there have also been notable improvements in instruments and methods.

One hundred and twenty-four determinations of the intensity of gravity, corrected for topography and isostatic compensation, were available in the United States before 1912. In the past ten years 162 such determinations have been added, making the total now available 286. This is a very substantial addition to the data of geodesy.

There are two lines of attack on the problem of determining the figure and size of the earth and on all associated matters such as isostasy. These two lines together are substantially the whole of geodesy. The primary data for one line of attack are observed values of the intensity of gravity as given by pendulum observations. The primary data for the other line of attack are observations of the relative directions of gravity at various places as given by astronomic determinations of the latitude, longitude and azimuth of points connected with continuous triangulation. The preceding paragraph shows that the available data for the first mentioned line of attack has been more than doubled in the United States in the past ten years. The paragraphs which follow give some of the points from the report which show that the strength available for the second line of attack mentioned has also been greatly increased on this continent in the past decade.

During 1912-1921 102 determinations of astronomic azimuth scattered widely over the United States have been made. The total number of such azimuth determinations before 1912 was 285. Similarly in this decade more than one fourth has been added to the number of determinations of astronomic longitude in the United States and 124 determinations of astronomic latitude have been made. To the network of primary triangulation in the United States which existed before 1912 there has been added in the last decade arcs of an aggregate length of 4,659 miles, or more than 66 degrees of a great circle on the earth's surface. Clarke's classical computation of the figure of the earth in 1880 depended on arcs measured by various nations of an aggregate length of only 89 degrees. In connection with the new triangulation of the past decade 20 new base lines have been measured with probable errors of one part in a million as a rule.

The accuracy with which the figure and size of the earth may be derived from a given continuous network of triangulation and the connected astronomic determinations increases very rapidly as the extreme dimensions of the network are increased. Within the decade under consideration, by cooperation on the part of Canada and Mexico, the continuous triangulation has been extended from the United States far into each of these countries and the computations are made on one standard datum.

This renders it possible to deal with the triangulation of all three of these countries in one grand computation,—a possibility not equalled anywhere else in the world at present.

More than 15,000 miles of precise leveling has been done in the United States in the past decade, all of the highest standard of accuracy. The total for the United States previous to 1912 was 30,000 miles, of which a part was of a lower grade of accuracy than the recent work. This leveling is primarily for engineering purposes for the control of surveys upon which good maps depend. But in due time the reviewer believes it will be found of much value to science as a means of measurement of the slow geological changes in the relative elevation of different parts of the earth's surface. Such changes may be detected at the coasts by direct reference to the mean surface of the sea. In the interior of a continent the precise leveling, repeated for this purpose, will furnish the only means for determining changes in relative elevation comparable in accuracy with the shore studies just referred to.

Among the more important improvements in apparatus made in the past ten years may be mentioned: (1) improvements in the precise leveling instrument, which many years of use had already shown to be the best instrument for its purpose in the world; (2) improvements in the precise level rods; and (3) improvements in the half-second pendulum apparatus and its auxiliaries intended to enable one to make the observations more rapidly and economically without any reduction of accuracy.

The brief statements which have been made show the character of the information given in the report, and some of the reasons why all who are interested in geodesy should have a copy. The report contains numerous especially well prepared maps showing the places at which each of the various classes of observations—astronomic observations, triangulation, gravity determinations, precise leveling—have been made. It also contains the best available summary, in several separate topical lists, of the bibliography of geodesy and closely related subjects in the United States in the past decade.

JOHN F. HAYFORD

SPECIAL ARTICLES

A HAPLOID MUTANT IN THE JIMSON WEED, "DATURA STRAMONIUM"

THE normal Jimson Weed is diploid (2n) with a total of 24 chromosomes in somatic cells. In previous papers[1] the finding of tetraploids (4n) with 48 chromosomes and triploids (3n) with 36 was reported, as well as unbalanced mutants with 25 chromosomes represented by the formula (2n + 1). The finding of two haploid or 1n plants, which we are now able to report, adds a new chromosomal type to the balanced series of mutants in *Datura*. This series now stands: 1n, 2n, 3n, 4n. Since a series of unbalanced mutants has been obtained from each of the other balanced types by the addition or subtraction of one or more chromosomes, it is possible that a similar series of unbalanced mutants may be obtainable from our new haploid plants, despite the great unbalance which would thereby result.

The haploid individuals were two from a number of plants of abnormal appearance secured in an attempt to induce chromosomal irregularities by the application of cold as a stimulus. The large amount of bad pollen consistently found in its flowers—80 per cent. and more empty grains have been counted—indicated, even before chromosome counts were made, that we were not dealing with a mutant of a previously known type. A detailed study of the assortment of chromosomes and of the possible breeding behavior is being undertaken. The cytological data so far as obtained, however, may be briefly summarized.

The late prophase, or metaphase, of the first division in pollen-mother-cells shows 12 unpaired chromosomes only. The cortex of the lateral roots also shows 12 chromosomes.

The 12 chromosomes in the pollen-mother-cell undergo a "reduction" into 3+ 9, 4+ 8, etc. These reduced groups divide in the second division forming usually 4 nuclei and subsequently 4 cells. The resulting young pollen grains with less than 12 chromosomes apparently all abort.

[1] SCIENCE, 1920, N. S. 52: 388-390; *Amer. Nat.*, 1921, 55; 254-267; *Amer. Nat.*, 1922, 56: 16-31.

Non-reduction takes place in some cells, as already described in triploid plants[2], resulting in 2 giant cells from each pollen-mother-cell instead of the 4 pollen grains expected after reduction. The pollen-mother-cells are about half the volume of the pollen-mother-cells of diploid Daturas. Apparently the giant cells form the surviving pollen grains of the haploid. Since they are half the size of mother-cells from which they arise (or one quarter the size of the mother-cells of diploids) they are equal in size to normal pollen grains of diploids and may be expected to function in the same manner.

Haploidy is the normal condition in gametophytes of all plants and is a regular occurrence in the males of such insects as honey bees, which, however, fail to undergo reduction at the formation of gametes. It has been reported as an occasional phenomenon in sporophytes of ferns.

A haploid plant in *Datura* is a genetic novelty among flowering plants for two reasons: first, it is a sporophyte and yet has the somatic chromosome number characteristic of the gametophyte of the species; and second, the chromosomes while in monosomes, or sets of one each, still undergo a process of reduction though without synaptic mates.

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THE MASS OF THE ELECTRON AT SLOW VELOCITY

ALL assumptions regarding the form of the electron in motion, with the possible exception of the Parsons magneton, lead to expressions for the longitudinal and transverse masses such that the mass of the electron at slow velocity is a constant, m_o, independent of the direction in which the inertia test is applied.

An experimental confirmation is being carried out with an apparatus similar to that previously used by one of the authors[1] except that the cold cathode is replaced by an incandescent filament to assure the presence of all possible velocities at the same time.

If an electron beam accelerated by a given discharge voltage emerges from a tube in the anode into the region between two horizontal metal plates forming an electrostatic field and if the electrostatic field be produced by the same voltage as the discharge, or a constant fractional part of it, then the point where the beam will strike the lower (positive) plate is independent of the discharge voltage and hence independent of the velocity of the electrons provided the transverse and longitudinal masses be equal. This will be the case for velocities below 10,000 volts.

Visual results show the position of the spot on the phosphorescent screen deposited on the lower metal plate to be independent of the exciting voltage, thus confirming the equality of the masses at slow velocity. The photographic record of spot position and a more complete description will be given later.

The method is equally applicable to electrons of high velocity. The experimental work of verifying the expressions for the transverse and longitudinal masses at high velocity is being continued.

L. T. JONES
H. O. HOLTE

THE HYDROGEN-ION CONCENTRATION OF SOILS AS AFFECTED BY DRYING[1]

MUCH interest has been manifested of late in the determination of the concentration of hydrogen-ions in agricultural soils and in the study and possible correlation of data thus secured. It was my privilege to attend the meetings of the American Chemical Society in New York last fall and, in one of the sections, to listen to a somewhat lengthy discussion of the probable effect of drying and heating soils on their P_H values. The discussion was of necessity largely a matter of opinion due to the paucity of experimental data bearing directly upon this phase of the subject.

During the past few months, in connection with research projects relating to the subjects of acidity and aluminum toxicity in soils, the

[2] Belling, John, and A. F. Blakeslee: "The assortment of chromosomes in triploid Daturas." In press for *Amer. Nat.*

[1] L. T. Jones: *Phys. Rev.*, 8, p. 52, 1916.

[1] Contribution 286 of the Station.

writer has had occasion to make large numbers of H-ion determinations, the gas-chain-electrometric method originally proposed by Hildebrand[2] and later modified for soil work by Sharp and Hoagland,[3] being employed.[4]

As is widely known, the Rhode Island Station has conducted several series of field plot experiments representing different rotations and various methods of fertilization, with but slight change over a period of more than thirty years. It is thus possible, by a proper choice of plots, to secure field samples of surface soils varying in P_H from 4.4 to 7.8 with a difference of but a few tenths of a P_H unit between successive samples. The following table presents data from such a series of samples, which are thought to be representative of the plots sampled.[5] The moist composite soil samples in tight Mason jars were brought to the laboratory immediately, rubbed through a ¼inch sieve, and the H-ion determinations made the same day as collected. Column 2 in the subjoined table presents the H-ion concentrations of these fresh soil samples. Portions of these same samples were then air-dried in the shade, and other portions oven-dried at 103° C. for a period of six hours. The last two columns give the P_H data secured from these dried soils.

H-ION CONCENTRATIONS OF FRESH AND DRIED SOILS

Soil No.	P_H Fresh, moist soil	P_H Air-dried soil	P_H Oven-dried soil
1	4.36	4.38	4.30
2	4.77	4.73	4.63
3	4.67	4.67	4.46
4	5.20	5.00	4.82
5	5.47	5.41	5.17
6	6.05	5.82	5.97
7	6.15	6.07	6.15
8	6.30	6.32	6.41
9	6.56	6.50	6.49
10	7.00	6.98	7.00
11	6.86	6.47	6.54
12	7.55	7.32	7.20
13	7.42	7.19	7.00
14	7.78	7.57	7.39

The following conclusions may be drawn from the accompanying figures. Drying *acid* soils, either at room temperatures or at 103° C., has but little effect on their H-ion concentrations as subsequently determined, although there appears to be a tendency toward slightly increased acidity at the higher temperature in practically every case. Drying *alkaline* soils, however, renders them decidedly less alkaline (decreases the OH-ion concentrations). This is especially noticeable where a temperature of 103° C. is used. In the case of soil 13, a decrease of 0.42 of a P_H unit is recorded, while soil 14 shows a decrease of 0.39 of a P_H unit. In the case of an exactly neutral soil (No. 10), drying has practically no effect. The reasons for these differences are somewhat obscure, although drying is doubtless accompanied by oxidation which is in itself an acidic process. It should be recalled that the soils in question are granitic soils of high potential acidity. Drying, heating, or otherwise profoundly changing them might conceivably present newly exposed surfaces to the solvent, possibly by removing certain enveloping colloidal materials of more or less alkaline nature; the definite fracture of certain of the mineral particles, thus directly exposing freshly abraded surfaces to the solvent is also by no means impossible. Further work will be necessary to establish a definite explanation. It is hoped that similar data from soils of widely different genesis may be forthcoming.

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[2] Hildebrand, J. H., 1913, "Some Applications of the Hydrogen Electrode in Analysis, Research and Teaching." *Jour. Am. Chem. Soc.*, 35, p. 847-871.

[3] Sharp, L. T., and Hoagland, D. R., 1916, "Acidity and Adsorption in Soils as Measured by the Hydrogen Electrode." *Jour. Agr. Res.*, VII, p. 123-145.

[4] The hydrogen electrode vessel was constantly shaken during saturation by a device operated by a small motor. This vessel carried two platinized electrodes, thus permitting duplicate voltage readings on the same solutions. This has been found by the writer to be a necessary precaution, as occasionally an electrode will "go bad" in slight degree only, and if no check is available, wrong results are unwittingly reported. Both electrodes in all of the above-listed results gave identical readings.

[5] The soil of all the plots is classified by the United States Bureau of Soils as Miami silt loam.

THE AMERICAN PHILOSOPHICAL SOCIETY

THE general meeting of the American Philosophical Society was held in Philadelphia on April 20, 21 and 22. The following papers were presented:

Our contradictory economic policy: E. M. PATTERSON.

The distribution of human ability in Europe: ELLSWORTH HUNTINGTON. The ability of a country depends not only on training and social environment, as has long been recognized, but also on inheritance, as is now rapidly becoming apparent, and on health or energy, a factor which has been much neglected. Europe affords one of the best fields in which to differentiate the influence of these three factors. Four lines of evidence are here used for this purpose: (1) the kind of contribution to human progress made by about 8,600 eminent Europeans who were born since 1600 and who are mentioned in the *Encyclopedia Britannica;* (2) the distribution of progress and of civilization according to the opinion of fifty experts in North America, Europe and Asia; (3) the distribution of health and energy as measured by the death rate; and (4) the distribution of climatic conditions that are favorable or unfavorable to health.

The eminent men mentioned in *Britannica* have been classified as follows: (1) religion and philanthropy; (2) philosophy and education; (3) natural sciences; (4) mathematical and chemical sciences and inventions; (5) history and economics; (6) literature; (7) art; (8) politics, and (9) war and adventure. This classification shows striking differences from country to country. For example: in proportion to the number of its people Switzerland, with its 107 representatives in *Britannica,* is very strong in religion, philosophy and the two branches of science, but falls low in all other lines; Scotland and Germany resemble Switzerland, except that the contrast between the extent to which their great men have devoted themselves to religion, philosophy and science on the one hand and to other lines of effort on the other is relatively not quite so great as in Switzerland; France, on the contrary, tends in the opposite direction, for religion and philosophy are comparatively neglected, while literature, art, politics and war are the lines toward which the French type of mind turns most strongly; Ireland follows the French type except that religion also receives emphasis, while the relative importance of war and especially politics rises very high.

Such contrasts and many others are presumably due in part to social environment but probably they also depend partly on racial inheritance. There seems to be no sociological reason why among the 1,737 eminent Frenchmen and 1,185 eminent Germans who appear in the encyclopedia the adjusted index numbers showing the extent to which the two countries have excelled in the various lines of human effort should be as follows: war, France 125, Germany 70; politics, France 105, Germany 49; history, 101 and 171; and philosophy, 83 and 214. Or take the following contrasts between the relative numbers for the 604 Scotch and 292 Irish: politics, Scotland 83, Ireland 164; mathematical sciences, 139 against 72, and natural sciences, 140 against 65. It seems as if these figures might be a rough index of certain deep-seated racial tendencies which manifest themselves in the whole social organization and history of the various countries.

When an attempt is made to show the geographical distribution of mental tendencies among the eminent men of Europe, the result is a series of erratically spotted maps which in many cases indicate little or no connection with environmental factors. Nor do they correspond at all closely to the fairly gradual and progressive character of the changes in social and sociological conditions from one part of Europe to another.

A map of the progressiveness or civilization of the countries of Europe as judged by fifty experts before the war, shows an aspect wholly different from that of the maps of special types of achievement. It displays an almost perfect gradation from higher to lower levels as one proceeds away from the regions bordering the North Sea. There are no sudden breaks from country to country. The distribution seems to be governed by factors which vary gradually and regularly from region to region instead of spasmodically and irregularly as in the previous cases.

A map of health based on the death rate before the war is almost identical with the map of civilization. The figures for all countries have been reduced to a standard population. Children under one year of age and old people of seventy-five or more have been omitted because an analysis of the statistics shows that in many countries the records of deaths at these two extremes of age are peculiarly unreliable. The way in which the map of health shows a decline in human strength and ability as one proceeds away from the North

Sea suggests a controlling factor akin to that which determines the distribution of civilization. Among the physical factors most likely to be related to human ability, climate holds high rank. A map of climatic energy based on a comparison between climatic factors on the one hand, and millions of deaths, thousands of cases of disease, and the work of thousands of factory operatives on the other, is almost identical with the maps of civilization and of health, but wholly different from any of the maps showing the distribution of particular types of achievement.

The resemblance of the maps of civilization, health and climatic energy is so great that it seems almost certain that there must be some common cause. Civilization undoubtedly has an influence on the distribution of health, but it cannot possibly affect the distribution of climate. Health likewise influences civilization, but cannot influence climate. Climate, on the other hand, may have some direct bearing on civilization, and it certainly produces indirect effects through agriculture, food and otherwise. It also has a great influence upon health, and its action upon civilization in this way is probably greater than its direct effect or perhaps than the indirect results arising through agriculture and food. The most reasonable explanation of the similarity of the three maps seems to be that climate influences health and health influences civilization.

The similarity of climate, health and civilization in their distribution in space appears to be supplemented by an equally strong similarity in their distribution in time. This matter has not yet been investigated in Europe, but in the United States variations in the weather from season to season and year to year are reflected with great fidelity in variations in the death rate and in the amount and character of work done by factory operatives on the one hand and students on the other. In other words, the quality and rapidity of people's work, that is, their ability, varies in harmony with the general health of the community and both vary in harmony with the weather. The order of the relationship can scarcely be other than weather, health, ability. Thus, whether we consider space or time, climate seems to be one of the determinants of the degree of ability of a race. On the other hand not only is racial inheritance presumably an important factor in determining the energy of a race, but in Europe, at least, it seems to be of great weight in determining the direction in which human energy shall direct its activities. Thus sociological environment seems to be largely the result of the interaction of human energy whose general distribution is greatly influenced by climate, and of racial inheritance which determines the lines along which nations shall express themselves in ideas and institutions.

George Hammond and Robert Liston—British ministers in Philadelphia, 1791-1800: J. F. JAMESON.

The Three Trinities: E. WASHBURN HOPKINS. Trinities must be sharply differentiated from triads; every trinity is a triad, but few triads are trinities. Examples from Greece and Persia. In India the first triadic union was that of the three fires, of earth, atmosphere, sky; but this was rather one god in three places than three forms of a god. The popular trinity of Brahman, Vishnu and Shiva was a theological compromise and has never had philosophic support. But the later trinity of the Ramanuja sect implies a Father God, an Absolute Brahma, and an incarnate human form of the godhead. A similar development is to be traced in the theistic Buddhism which has always been more potent than the doctrine of the Madhyamikas. The Christian or Greek trinity combines in the same way the ideas of godhead, personal God and incarnate divinity. At the base, all three are attempts to express the same religious-philosophical conception of a spiritual source of the world manifested as personal spirit in heaven and in human form on earth. Possibility of subsuming these three trinities under one head, a new trinity that might unite the three great religions.

The use of devices for indicating vowel length in Latin: JOHN C. ROLFE. In the pronunciation of Latin of the classical period great importance was attached to the quantity of vowels. From the time of Sulla until about 300 A. D. the Romans employed various devices for indicating vowel length, especially the apex, which usually had the form of an acute accent, and a tall I, to indicate the long form of that vowel. These marks are found in inscriptions, but all the long quantities are almost never indicated in any one inscription. The paper attempts to discover some of the principles according to which the marks are used. The examination of the "Monumentum Ancyranum," a copy of the inscription in which the Emperor Augustus recorded the deeds of his reign, of the speech of Claudius at Lyons in 48 A. D., and of several thousand shorter inscriptions indicates that the marks are frequently used with personal names, with titles of honor and for

emphasizing some other words, with words denoting family relationships, with suffixes, prefixes and case-endings, and sometimes, apparently, to indicate punctuation. Although Quintilian says that their proper use was to distinguish words and case-endings which are alike in spelling but different in quantity, that rule is comparatively seldom followed in the extant inscriptions.

A sketch of the modern faeroe dialect: J. DYNELEY PRINCE.

The novæ or "new stars": E. E. BARNARD. This paper dealt with the peculiarities of the novæ or "new stars." These are not new stars in the ordinary sense of the word. They are stars whose original condition was very faint or even beyond the reach of any telescope, that suddenly, from some unknown cause, become very bright even to the naked eye—in some cases increasing their light as much as a hundred thousand fold. They then fade away, perhaps never to become bright again. All of this great increase of brightness occurs within a few hours' time, or a few days at most. The outburst of light is very sudden; the decline is at first rather rapid, then slower, and with many halts and minor outbursts they finally in a few years' time, say from eight to ten or fifteen years, return to their original brightness. This interval seems to vary with different stars. Some of these wonderful objects, such as the great nova of 1572, have become visible to the naked eye at midday. Two of them in recent years became brighter than the first magnitude. One of these, Nova Aquilae of 1918, for one day outranked every star in the entire heavens except Sirius and possibly Canopus. At first we did not know anything of the previous history of these strange stars. They suddenly appeared as if a new star had just been created. But in recent years photography has added much to our knowledge of them. Now when a nova appears we search for it on our photographic plates made before the star's outburst. Sometimes we find that previous to this outburst the star was beyond the reach of even the photographic plate, while in other cases they are shown to have formerly existed as very small stars with nothing to distinguish them from the millions of other small stars that dot the sky. In several instances we have found that previous to its outburst the nova had existed as a faint variable star, rhythmically changing in brightness by a small amount. The great star of 1901, Nova Persei, is one of these that had probably existed for ages as a small variable before it became a nova. Watched carefully now, this star fitfully varies through a couple of magnitudes, as it probably did in its original condition. What causes the tremendous outburst of light in these wonderful stars is not known.

The message of a meteorite: MONROE B. SNYDER.

The effect of diurnal variation of clock rates upon longitude work: R. H. TUCKER. From observations with the meridian circle, pendulum clocks appear to run faster at night than the average rate during a period of one day. The excess each hour is small, but the daily rate at midnight appears to be from two to three tenths of a second larger than the daily rate at noon. The largest error that would occur in predicting the correction to an astronomical clock would be between two and three one-hundredths of a second. The observed variation may be due to a diurnal variation in the meridian plane. Such a variation, with a period of fourteen months, does occur, owing to the deviation of the axis of rotation of the earth from the axis of figure of the earth. There is a small diurnal term in the observed latitude at the Lick Observatory, the full amplitude of which is about three tenths of a second of arc. Small corrections to the adopted astronomical constants of aberration, or nutation, may be indicated by these anomalies of observation. An exchange of longitude signals between two stations, ninety degrees apart, might give a resulting difference of longitude from two to three one-hundredths of a second in error. Between two stations on opposite sides of the earth the error might be double that amount. Exchange of wireless signals, sent automatically by clocks across the Atlantic, may give us a test of a variation in clock rates.

Discussion of a kinetic theory of gravitation, II; and some new experiments in gravitation: CHARLES F. BRUSH.

Arc spectra and ionization potentials in dissociated gases: K. T. COMPTON, with O. S. DUFFENDACK and P. S. OLMSTEAD. The great complexity of spectra of gases is due, in part, to the fact that the molecules of the gas may exist in various states of dissociation, association and ionization, each type of molecule or atom giving rise to its own characteristic spectrum. A discovery of the exact state of the atoms or molecules giving rise to each part of the spectrum of a substance is of great importance as regards both the theory of spectral emission and the theory of atomic and molecular structure. At the Palmer

Physical Laboratory this problem is being attacked from three different angles. This paper presents some discoveries relating to the excitation of radiation and ionization in hydrogen and nitrogen.

Hydrogen: Two methods of investigation have been employed. In the first, an arc was produced in hydrogen by the electronic discharge from an incandescent tungsten wire to a surrounding coaxial tungsten tube, which could be electrically heated. The voltages at which discontinuities appeared in the current between the electrodes and especially the voltage at which the arc struck indicated the critical potentials for the setting in of radiation or ionization. With the outer tube cold the hydrogen was in the ordinary molecular state. With the outer tube at a temperature near the melting point of tungsten, the hydrogen was completely dissociated into *atomic* hydrogen. Thus the effects due to the molecule and those due to the atom could be definitely distinguished from each other. This is the first experiment ever performed in an atmosphere of pure atomic hydrogen. The following results were obtained: (1) An arc can not be produced or maintained in molecular hydrogen at voltages less than 16 volts, which is the ionizing potential of the molecule. (2) In atomic hydrogen the arc struck easily at 13.5 volts and, with very large electronic currents, at 10.1 volts. These are, respectively, the ionizing and radiating potentials of the hydrogen atom as given by Bohr's theory. (3) The hydrogen line spectrum was observed whenever the arc struck. It was not observed below 16 volts in molecular hydrogen, but was observed as down to 10 volts in atomic hydrogen. (4) The hydrogen secondary spectrum was not observed below 16 volts and the only lines found in this spectrum were those of the group which shows no Zeeman effect. (5) The Balmer series lines were reversed in the hot tube, provided the gas was ionized. The second method was that of Franck and Hertz, modified to permit a variation in the relative proportions of atomic and molecular hydrogen by use of a grid of hot tungsten wires, and to enable effects of radiation to be distinguished from those of ionization. These results corroborated those of the above method and showed, further, that the hydrogen molecule can be ionized without dissociation and that the lines of the Lyman series can probably be separately excited at successively higher voltages.

Nitrogen: In the hot tungsten tube, there was no certain evidence of dissociation into atomic nitrogen by heat alone, but there was evidence that nitrogen was more easily dissociated by electron impacts in the hot than in the cold tube. The atomic nitrogen was chemically active, combining with the tungsten of the tube furnace, and it greatly increased the conductivity of the gas between the electrodes. The presence of atomic nitrogen was indicated by this increased conductivity of the gas or by the emission of lines of the nitrogen line spectrum. The following conclusions have been reached with regard to the nitrogen spectrum: (1) The three groups of positive bands are all due to the neutral nitrogen molecules. (2) The negative bands are due to the ionized nitrogen molecules. (3) The bands of the third positive group are excited at about 7 volts, those of the second positive group are excited below the ionizing potential and decrease in intensity as the voltage is raised above the ionizing potential, those of the first positive group were not observed below the ionizing potential and increased in intensity with increasing voltage, and the negative bands were first observed at one or two volts above the ionizing potential and increased greatly in intensity with increasing voltage. (4) Several new components of bands in the first group of negative bands were discovered, and their wave lengths agreed accurately with those predicted by Deslandre's formula. (5) The line spectrum was not observed below 70 volts, which is also the voltage at which evidence of atomic nitrogen is obtained. The minimum arcing voltage, about 16.5 volts, is due to ionization without dissociation of nitrogen molecules. The relation of these results to observations made in other connections is briefly considered.

Recent developments in vacuum tubes and their use: J. H. MORECROFT.

A primary standard of light: HERBERT E. IVES. The standard investigated is one developed after the suggestion of Wardner and Burgess, namely, the black body or complete radiator at the melting point of platinum. In order to realize this practically, hollow cylinders of platinum are raised to the melting point by the passage of a heavy electric current. The light emitted from a small opening is observed by a photometer upon whose field an image of the cylinder is thrown by a lens. It is found that with highly purified platinum the value obtained for the brightness of the black body is 55½ candles per square centimeter. This standard appears to be more reproducible than any now available, and can be directly correlated with other physical constants.

Surface equilibrium of certain colloid solutions: P. LECOMTE DU NOÜY.

Notes on the ecology of the clovers (trifolium): JOHN W. HARSHBERGER.

The cytoplasm in development and heredity: E. G. CONKLIN. It is generally recognized that the chromosomes of the germ cells are the seat of the inheritance factors or genes, while the cytoplasm of those cells is the chief if not the exclusive seat of embryonic differentiation. Nevertheless it is generally recognized that there is a mutual interaction between the chromosomes and the cytoplasm, and that each may be said to be environment to the other. It is extremely probable that in the course of development the chromosomes and genes undergo little if any differentiation. On the other hand, it is perfectly evident that the cytoplasm does undergo such differentiation. The mechanism of differentiation consists in the reaction of identical chromosomes upon different kinds of cytoplasm. It is therefore impossible to assume that all factors for heredity and differentiation are located in the chromosomes.

The supposed serial arrangement of the genes and its relation to theories of crossing-over in inheritance: H. S. JENNINGS. This paper was a mathematical investigation of the laws according to which hereditary characteristics are distributed to organisms. It was shown that these laws agree in great detail and in many diverse ways with what is mathematically required if the substances on which the hereditary characteristics depend are arranged in the germ cells in serial order, as held by the so-called linear theory.

The relation of the retinal image to animal reactions: G. H. PARKER.

Parallel mutations in oenothera: GEORGE H. SHULL.

Some climatic and topographic characters in the rings of the yellow pines and sequoias of the Southwest: A. E. DOUGLASS. The average growth of the giant sequoia in the General Grant National Park region was found to be 7.6 cm. per century in the last five hundred years. It varies from half of this to double this amount in locations with respectively unfavorable and favorable water supply. Evidence of the climatic origin of cycles in tree growth is found in the extensive areas over which such cycles prevail, and in the historical agreement between variations in tree growth and solar activity. The eleven-year sun-spot cycle appears both in the Arizona pines and in the California sequoias. This cycle has been operating since before 1400, but largely disappeared from about 1640 to 1715, at which time there was a prolonged sun-spot minimum.

The probable action of lipoids in growth: D. T. MACDOUGAL. Renewed interest in the fundamental composition of protoplasm, especially with respect to the importance of the lipoids, or fatty substances, has been aroused by the investigations of the last two years. Czapek in Prague has made additional demonstration of the universal presence and abundance of such material in plant cells, especially in the growing stage. Hansteen-Cranner in Norway claimed to have demonstrated a peripheral deposit of lipoids in the cell with meshworks extending into the wall and into the mass of the protoplasm where it constitutes the fundamental structure. Kahho at Dorpat finds that the contraction and expansion of lupine roots in solutions of neutral salts is in accordance with a condition of permeability which might be due to the presence of such a lipoid layer. Boas at Weihestephan saw that when solutions such as those of saponin, which displace or liquefy lipoids, are applied to plant cells, their permeability is notably increased. Other workers hold to the theory of the primary importance of proteins in the plasma, and as forming the outer or plasmatic membrane. The results of my own work justify the conclusion that all substances which form watery emulsions or set as reversible gels, principally albuminous compounds, mucilages, soaps and lipoids, are to be included in the hydration or growth mechanism. The present paper treats of the results of two series of experiments bearing upon the action of the lipoids. The effects of lecithin were tested by the use of the artificial cell designed in 1921. This lipoid was found to exert but little effect on absorption when incorporated in the "plasma," but to influence absorption in a very marked manner when used as a peripheral layer or "plasmatic" membrane. The solutions which affect the living cell, supposedly by dissolving the lipoidal layer, have a similar effect on the artificial cell. The reactions of living and of dead cell-masses to soponin and hydroxides include variations in swelling and in permeability, which are of a character suggesting the liquefaction of a lipoidal layer. These experiments do not offer decisive evidence of the actuality of such a layer, yet it is notable that nothing was found which could be interpreted adversely to such an arrangement of material in the cell: Material which is abundantly present and which would tend to assume a peripheral

position in a colloidal mass of this character. Furthermore, it is to be noted that the argument against the possibility of a lipoidal membrane on the ground that it would not permit the passage of both fat-soluble and water-soluble material, is voided by the fact that the lipoids may occur in a system in which a disperse phase swelling in water but not soluble, is held in a medium consisting of water-soluble lipoid. Organic substances, fats and salts, would readily pass through such a system.

Possible explanation of eocene climates: EDWARD W. BERRY. This paper discusses the contrast in the floras of the upper Eocene with latitude, and their probable climatic significance. After analysing the fossil floras of the far North in the light of paleogeographic conditions, the speaker suggests that the indicated mild climate in high latitudes during the upper Eocene was the result of the widespread submergence of lands during middle Eocene times, with expanded seas in the equatorial regions and free access of warm ocean currents to Artic seas.

The power and impotence of man: VERNON KELLOGG.

Hydracodons from the Big Badlands of South Dakota. The small entelodonts of the White River Oligocene: W. J. SINCLAIR. These papers present the results of evolutionary studies on two unrelated animal groups, the swift running (cursorial) rhinoceroses and the entelodonts or so-called "giant pigs," both extinct, but formerly inhabiting South Dakota and adjacent areas. In the case of the hydracodons, a progressive evolution is indicated, an increasing complexity of the structure of the upper premolar teeth, with a series of size variants under each of the four structural types recognized. Among the entelodonts, while the extremes of the series studied are far enough apart to appear specifically distinct, there are so many intermediate stages and the grouping of characters is so irregular that almost every specimen would have to be made a separate species or else the lot referred to one species, apparently made up of several inter-breeding strains which differ by various small unit characters or combinations thereof, transmitted to the individual from the various pure lines which enter into its ancestry.

Lithology of White River sediments: H. R. WANLESS. The White River sediments of the Big Badlands are composed of the following types of sediments: (1) channel sandstone; (2) freshwater limestone; (3) nodular layers; (4) volcanic ash beds; and (5) clay beds. A petrographic study of these sediments has shown that most of them are derived from erosion of the rising dome of the Black Hills during the Oligocene period. In the channel sandstones many fragments of garnet, tourmaline and other schist and pegmatite minerals point to direct derivation from the Precambrian core of the hills. Traces of volcanic glass and pumice are present throughout the series, but form the majority of the Leptauchenia beds (the upper division of the White River), which is about two hundred feet thick. Eolian action, as evidenced in rounded sand grains, is only locally present, and forms a negligible part of the whole. Ground water circulation is indicated by chalcedony veins, mineral fillings of cavities in the ash beds, and deposition of oxides of iron at the bottom of the series in and on the impervious Pierre shales. The series as a whole is formed as a flood plain deposit, with shallow shifting channels, local ponds and local sand dunes.

Lava domes and their composition in the Malay Archipelago: H. A. BROUWER.

The application of bio-physical researches to physiological problems: GEORGE W. CRILE and HUGO FRICKE. Following researches on the electric conductivity of animal tissues already presented, a further attempt to apply bio-physical methods to the interpretation of physiological problems has been made by making measurements of temperature variations of various tissues in living animals under varying conditions by means of specially constructed copper-constantan thermocouples. These were used in connection with a specially designed potentiometer and mirror-galvanometer, one division on the galvanometer scale corresponding to 0.01° C. In most of the experiments simultaneous measurements of the temperature variations in two different organs have been made. The principal tissues thus far studied have been the brain, the liver, the thyroid, the adrenals, the voluntary muscles, the spleen, the pancreas, the intestines, the kidneys and the blood stream. The effects produced on the temperature of one or more of these organs by emotion, by adrenalin, by ether, by nitrous oxid, by calcium, by magnesium, by cyanides, by the excision of certain organs, etc., have been noted. The results show that this method of bio-physical measurement offers new criteria for the interpretation of certain operations of the animal mechanism, and emphasizes the value of the application of bio-physical methods of the study of this operation of the animal mechanism.

Experiments in epidemiology: SIMON FLEXNER.

The experiments in epidemiology, carried out with Doctor H. L. Amoss, have been made with an infectious disease arising among mice to which the name of "mouse typhoid" has been given. The bacilli inciting the disease are readily grown outside the body and reproduce the natural disease when fed to healthy mice. The purpose of the experiments, which have extended over three years, is the elucidation of the factors responsible for the epidemic spread of disease among man and animals. Hitherto these factors have been sought chiefly by the analysis of records of disease and death in man; this study represents an effort to obtain more accurate data through direct observation of an epidemic disease purposely induced in small laboratory animals.

Fishes used in Guayaquil for mosquito control against yellow fever: CARL H. EIGENMANN.

The carbonic acid of the blood in health and disease: LAWRENCE J. HENDERSON.

Some recent experiments concerning the nature of the function of the kidney: A. N. RICHARDS.

The Biblical manna: PAUL HAUPT. The biblical manna was manna-lichen mixed with tamarisk-manna and alhagi-manna. The manna-lichen (Lecanora esculenta) was ground in querns, or pounded in mortars, and mixed with the honey-like drops exuding from the soft twigs of tamarisks or with the exudation of camel's thorns. After this mixture had been baked it tasted like honey-cake (Exod. xvi. 31) or like pastry baked in sweet-oil (Numb. xi. 8). In the early morning the tamarisk-manna is like wax, but it melts in the heat of the sun (Exod. xvi. 21). The accounts in Exod. xvi. 14-36 and Numb. xi. 7-9 are inaccurate and embroidered. The ancestors of the Jews were at that time, not on the Sinaitic peninsula, but in northwestern Arabia.

The earth inductor compass: PAUL R. HEYL and LYMAN J. BRIGGS. A model of the U. S. Air Service earth inductor compass, as developed at the Bureau of Standards, and to which the society awarded its magellanic medal, was shown and demonstrated. This instrument is designed for use in aircraft, where the ordinary magnetic compass is unreliable. The fundamental principle of its action is not new, but no previous attempts at the construction of a compass on this principle have given satisfactory results. In the Air Service model a revolving coil of wire is installed in the rear part of the airplane, where the magnetic disturbance from the engine is negligible. Current from this coil is led by wires to the instrument board, where, by an entirely new device called a dial switchboard, the pilot can so arrange the electrical connections that an indicating galvanometer before him will read zero only when the vessel lies in the desired course. An effective compensation for rolling and pitching is provided, and by the judicious use of iron in the core of the coil the size of the instrument is kept down sufficiently to permit of its installation in the limited space available in an airplane.

The age of the earth from the geological viewpoint: T. C. CHAMBERLIN.

Age of the earth from the paleontological viewpoint: JOHN M. CLARKE. The age of the earth from the point of view of the student of the life upon it, can be expressed only in comparative terms. The paleontologist has been accustomed to accept without much debate the allotments of time that astronomers and students of celestial mechanics have been disposed to assign for its age as a planetary body. Life could not have begun until long after the earth had started on its individual planetary existence. No one knows how long it takes a species of animal or plant to acquire its specific characters or to attain changes in characters that would show the passage of one species into another. Animal and plant life have grown under all possible differences of physical surroundings, and the rate of growth and change is in direct relation to the environment. Some animals have endured through geological ages without change while others have developed changes explosively. It is improbable that there will ever be a basis for estimating how long it takes or has taken for one species to pass into another, or to estimate concretely the endurance of the life of any single species. The beautifully preserved fossils of the ancient life of the Cambrian Period which lies almost at the base of the record of life as registered in the rocks, show such perfection of anatomical detail and such an advanced degree of specialization in organs and functions, that though they stand near the very threshold of the recorded panorama of life, their structure demonstrates that it has taken uncountable ages for them to arrive at such a high degree of specialization. In other words, inasmuch as starts are slow and as the starting point was the nuclear cell, the length of time required in rising from the undifferentiated cell by evolutionary processes to the extraordinary animals of the very ancient Cambrian period must have been vastly greater than all the time that has passed since the Cambrian period to the age of man. The same fact has been made very